Evaluate each function

$h(n) = -2n^2 + 4$; Find $h(4)$

$h(4) = -2(4)^2 + 4$

$= -28$

$f(x) = x^2 - 3x$; Find $f(-8)$

$f(-8) = (-8)^2 - 3(-8)$

$= 64 + 24$

$= 88$

$p(a) = -4^{3a}$; Find $p(-1)$

$p(-1) = -4^{3(-1)}$

$= -4^{-3}$

$= \frac{1}{-4^3} = -\frac{1}{64}$

$p(a) = a^3 - 5$; Find $p(x-4)$

$p(x-4) = (x-4)^3 - 5$

$(x-4)(x-4)(x-4)$

$(x-4)(x^2 - 8x + 16)$

$x^3 - 8x^2 + 16x$

$-4x^2 + 32x - 64$

$x^3 - 12x^2 + 48x - 64 - 5$

$x^3 - 12x^2 + 48x - 69$

COMPOSITION OF FUNCTIONS

f circle g

The composition of functions *f* and *g* is written $f \circ g$ and is defined by

$$(f \circ g)(x) = f(g(x))$$

We read $f(g(x))$ as f of g of x.

EXAMPLE 10.2

For functions $f(x) = x^2 - 4$, and $g(x) = 3x + 2$, find: ⓐ $(f \circ g)(-3)$, ⓑ $(g \circ f)(-1)$, and ⓒ $(f \circ f)(2)$.

a) $(f \circ g)(-3) = f(g(-3))$

$\to g(-3) = 3(-3) + 2$
$= -7$

$(f \circ g)(-3) = 45$

$f(-7) = (-7)^2 - 4$
$= 45$

b) $(g \circ f)(-1)$

$f(-1) = (-1)^2 - 4$
$= -3$

$(g \circ f)(-1) = -7$

$g(-3) = 3(-3) + 2$
$= -7$

c) $(f \circ f)(2)$

$f(2) = (2)^2 - 4$
$= 0$

$(f \circ f)(2) = -4$

$f(0) = 0^2 - 4$
$= -4$

For functions $f(x) = x^2 + 1$, and $g(x) = 3x - 5$, find ⓐ $(f \circ g)(-1)$, ⓑ $(g \circ f)(2)$, and ⓒ $(f \circ f)(-1)$.

a) $(f \circ g)(-1) = f(g(-1))$

$g(-1) = 3(-1) - 5$
$= -8$

$f(-8) = (-8)^2 + 1$
$= \boxed{65}$

b) $(g \circ f)(2) = g(f(2))$

$f(2) = (2)^2 + 1$
$= 5$

$g(5) = 3(5) - 5$
$= \boxed{10}$

$(f \circ f)(-1) = f(f(-1)) =$

$f(-1) = (-1)^2 + 1$
$= 2$

$f(2) = 2^2 + 1$
$= \boxed{5}$

For functions $f(x) = 4x - 5$ and $g(x) = 2x + 3$, find: ⓐ $(f \circ g)(x)$, ⓑ $(g \circ f)(x)$, and ⓒ $(f \cdot g)(x)$.

a) $(f \circ g)(x) = f(g(x)) = 4x - 5$

$f(2x+3) = 4(2x+3) - 5$

$= 8x + 12 - 5$

$= \boxed{8x+7}$

b) $(g \circ f)(x)$

$g(f(x)) = 2x+3$

$g(4x-5) = 2x+3$

$2(4x-5)+3$

$8x - 10 + 3$

$\boxed{8x-7}$

c) $(f \cdot g)(x)$

$(4x-5)(2x+3)$

$8x^2 + 12x - 10x - 15$

$8x^2 + 2x - 15$

For functions $f(x) = 4x - 3$, and $g(x) = 6x - 5$, find ⓐ $(f \circ g)(x)$, ⓑ $(g \circ f)(x)$, and ⓒ $(f \cdot g)(x)$.

a) $(f \circ g)(x) = f(g(x)) = 4x - 3$

$f(6x-5) = 4(6x-5) - 3$

$= 24x - 20 - 3$

$24x - 23$

b) $(g \circ f)(x) = g(f(x)) = 6x - 5$

$g(4x-3) = 6(4x-3) - 5$

$24x - 18 - 5$

$24x - 23$

c) $(f \cdot g)(x) = f(x) \cdot g(x)$

$(4x-3)(6x-5)$

$24x^2 - 20x - 18x + 15$

$24x^2 - 38x + 15$

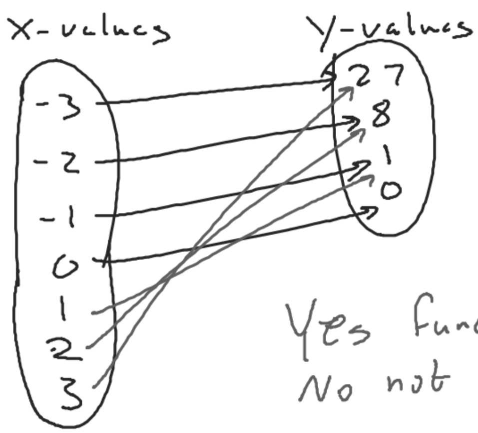
1, 3, 5, 9, 11

ONE-TO-ONE FUNCTION

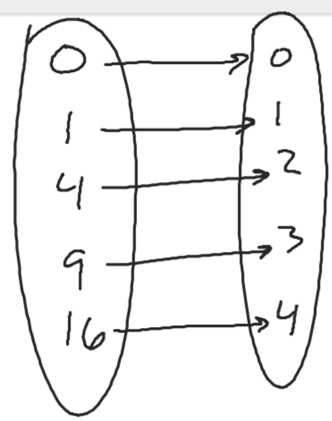
A function is **one-to-one** if each value in the range corresponds to one element in the domain. For each ordered pair in the function, each *y*-value is matched with only one *x*-value. There are no repeated *y*-values.

For each set of ordered pairs, determine if it represents a function and, if so, if the function is one-to-one.

ⓐ $\{(-3, 27), (-2, 8), (-1, 1), (0, 0), (1, 1), (2, 8), (3, 27)\}$ and ⓑ $\{(0, 0), (1, 1), (4, 2), (9, 3), (16, 4)\}$.

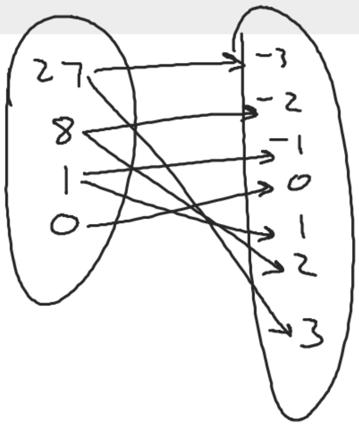


Yes function
No not one-to-one

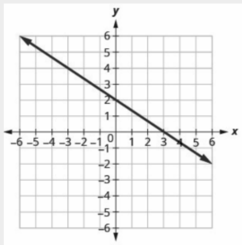


For each set of ordered pairs, determine if it represents a function and if so, is the function one-to-one.

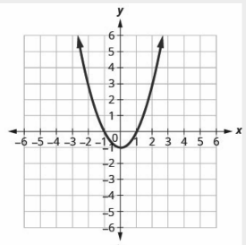
ⓐ $\{(27,-3),(8,-2),(1,-1),(0,0),(1,1),(8,2),(27,3)\}$ ⓑ $\{(7,-3),(-5,-4),(8,0),(0,0),(-6,4),(-2,2),(-1,3)\}$



Determine ⓐ whether each graph is the graph of a function and, if so, ⓑ whether it is one-to-one.



(a)



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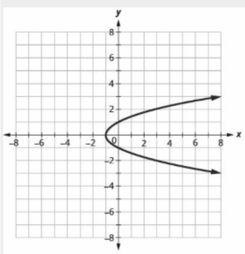
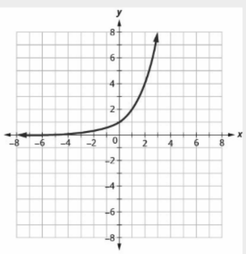


(a)



(b)

13, 17-20